

PART I - GLOSSARY

This glossary is intended to assist Department personnel in understanding the significance of some of the words and terms used most frequently on Projects. In most instances, the definitions or explanations are given as they are used or known in our State, rather than the technical or universal meaning.

Words or phrases in the definitions shown in italics are defined elsewhere in this Part of the Manual.

Absorbed water. All the water absorbed by an *aggregate* until it reaches the saturated-surface dry (SSD) condition, which is the point when the *aggregate* is internally saturated but externally dry. Absorbed water is usually expressed as the ratio of the weight of water absorbed by the *aggregate* sample to the dry weight of the sample:

METRIC

$$\% \text{ Absorbed Water} = \frac{\text{weight of water (grams)}}{\text{weight of dry aggregate (grams)}} \times 100$$

ENGLISH

$$\% \text{ Absorbed Water} = \frac{\text{weight of water (ounces)}}{\text{weight of dry aggregate (ounces)}} \times 100$$

Abutment. A structure, usually made of *portland cement concrete*, stone, or masonry, located at each end of a *bridge*, designed to withstand earth pressures as well as forces exerted by the *superstructure*.

Accelerator. An *admixture* that, when added to a batch of *portland cement concrete*, accelerates cement hydration, causing the *concrete* to develop strength more rapidly.

Acetylene torch. A device used to cut or weld metal. The torch consists of a nozzle having valves to control the flow of acetylene and oxygen gases and devices to combine the gases to produce a very hot flame.

Acidity. A chemical property of a solution having a pH less than 7.

Adhesion. The force by which one substance clings to a substance of a different nature.

Admixture. A substance, other than cement, water, or *aggregate*, added to a batch of fresh *concrete* in the mixer to alter any of the normal properties of the *concrete*.

Aggregate. Inert mineral material, such as sand, *gravel*, crushed stone, slag, or the combination thereof, with which cement or *bituminous material* is mixed to form a *mortar*, cement *concrete*, or *bituminous concrete*. Aggregates are also used to construct *base courses*. Aggregates are defined as coarse or fine, based on their gradations.

- (1) Coarse aggregates are those whose smallest particles are predominately retained on a US Standard No 4 (4.75-mm) sieve.
- (2) Fine aggregates are those whose largest particles will pass a 3/8" (9.5 mm) sieve and predominately will pass the US Standard No 4 (4.75-mm) sieve. Fine aggregates are commonly referred to as sand.

Aggregate voids. The space in a compacted *concrete* mixture not filled with *aggregate*, usually reported as a percentage of the bulk volume of the compacted material.

Air entrained concrete. *Concrete* containing a small percentage, usually 5% to 9% by volume, of minute, disconnected, uniformly distributed air bubbles that have been purposely entrained. The entrained air acts as a very elastic and stable non-reactive fine *aggregate* with a high lubricating value. The use of entrained air permits an appreciable lowering of the water-cement ratio required to produce the desired workability of the *concrete*. Entrained air also improves the resistance of concrete to the effects of repeated freezing and thawing. Air entrainment is obtained by the addition of an *admixture* to the *portland cement* during manufacture (air entraining *portland cement*) or by the addition of an *admixture* at the concrete mixer.

Air entraining agent. An *admixture* for *concrete* containing a chemical that causes a *concrete* mix to have microscopic air bubbles throughout, usually for the purpose of improving resistance to freezing and thawing. As the water within the *concrete* freezes and expands, the resulting pressure can be absorbed by empty air *voids*, thus preventing a build-up of damaging pressure. It also improves workability of the mix due to the lubricating effect of the air bubbles.

Alignment. The ground plan of a highway as seen from above and as shown on a map or drawing, also called horizontal alignment. The *profile* drawing is the vertical alignment.

Alkalinity. A chemical property of a solution having a pH greater than 7.

Anchor bolts. Steel bolts set within masonry or *concrete* at a specified depth, with a threaded section exposed, for securing a part or portion of the structure such as a *beam* or *column*.

Anchor studs. Small steel *bars* or straps, usually with hooked ends, welded to the *expansion joints* used in a structure. After the *concrete* next to the joints has hardened, the anchor *bars* hold the joints firmly in place.

Angle. The degree of inclination between two lines or two or more surfaces that meet. The term angle is also used to describe a structural shape.

Approach slab. A section of the roadway that is built over the *backfill* of an *abutment*, and leads up to the *bridge* itself. It is intended to minimize the possibility of *settlement* of the roadway at the structure.

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Arch. A structure with a curved under-surface that supports a highway over an opening. Structurally, an arch carries vertical loads while an *abutment* provides resistance to horizontal loads. A typical arch, with its various components, is shown and described below.

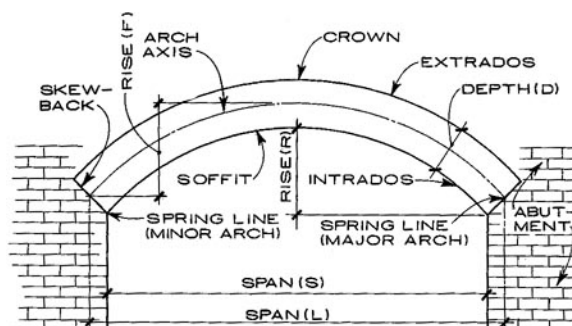


Figure I-1: Components of a Typical Arch

- (a) *Extrados.* The intersection of the curved back or upper surface of an arch with a vertical plane parallel to the *centerline* of the roadway.
- (b) *Intrados.* The curve of the intersection of the soffit plane and a vertical plane parallel to the *centerline* of the roadway; the interior curve or surface of an arch or vault.
- (c) *Rise.* The vertical height from the spring line to the lower face of the crown or arch.
- (d) *Skewback.* The surface of the *abutment* of an arch culvert upon which the arch ring rests.
- (e) *Spring line.* The line at the junction of the main part of an arch and its supports.

Arch ring. The entire curved structure of an arch between the *abutments*.

Arc-welding. Joining metal parts by fusion in which heat is supplied by an electric arc between two electrodes or between one electrode and the grounded part.

Ashlar rubble masonry. Masonry composed of squared stones with finished faces laid in horizontal courses and held together by *mortar*.

Asphalt. A dark brown to black organic, cementitious material that is solid, semi-solid, or liquid in consistency. Asphalt can occur in nature (native asphalt) or as a residue in the refining of petroleum (artificial asphalt).

Asphalt cement. A heavy *binder* used in the preparation of asphaltic mixtures. It is designated by selecting a penetration grade or degree of hardness suitable for the type of construction.

Auger. A type of drill used to obtain *soil* samples for soil investigation.

Axis. One of the principal straight lines drawn through the center of a geometric figure, especially the longest and shortest of such lines.

Backfill. (1) *noun*. That material used to replace an excavated area. (2) *verb*. To fill with *soil*, stone, or similar materials to a given grade.

Backwall. That portion of an *abutment* above the *bridge seat* that prevents the *backfill* from spilling onto the *bridge seat*. It also holds the end dam or expansion device in place.

Bar. A square or round rod. Flat steel up to 6" (150 mm) in width is also considered to be a bar.

Bar chair. A device that holds reinforcing *bars* the correct distance from the *forms* for *concrete*. It may also be called a slab bolster or slab spacer.

Bar schedule. A table of information on the reinforcing *bars* to be used in a structure. The information listed in the bar schedule includes the size, length, shape, and identification mark for each type of *bar*.

Base course. See Pavement Structure.

Baseline. A reference line from and to which the important measurements are made and dimensions are given.

Base plate. See Sole Plate.

Batter. The inclination from the vertical of a *pile* or the face of a wall.

Bay. The area between two successive *trusses* or transverse *bents* in a structure.

Beam. A horizontal member forming part of the frame of a structure. It rests on supports and is susceptible to transverse stress. Beams are defined based on how they are supported.

- (a) *Cantilever*: A *beam* that has one or both ends overhanging the support for the *beam*; or a *beam* that has one end firmly fixed and the other end unsupported.
- (b) *Continuous*: A *beam* that rests upon more than two supports.
- (c) *Fixed*: A *beam* that has both ends firmly secured.
- (d) *Simple*: a *beam* that is supported at each end.

Beam seat. The area of the *abutment* or *pier* upon which the *beam* rests.

Bearing area. The part of the top surface of a mass of *concrete*, such as a *pier*, *abutment*, or *footing*, on which a *bridge* beam is directly supported. The bearing area is sometimes referred to as the bearing seat.

Bearing pile. A *pile* driven to resist horizontal and vertical forces caused by bearing. Bearing piles rest on a hard stratum, usually of rock, that underlies the *soil* and transfers the load to this hard stratum.

Bearing plate. A steel plate used to distribute a load over a larger area.

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Bent. A vertical framework usually consisting of a *beam* or cap supported by *columns* or piles.

Binder. The material used to promote the cohesion and uniform consistency of aggregate particles to prevent the entrance of moisture, act as a cushioning agent, and, in some cases, to waterproof the entire road surface.

Binder course. A mixture of *asphalt*, *aggregates*, and mineral filler frequently used between the wearing course and the *base course*.

Binder soil. That material which consists primarily of fine *soil* particles (fine sand, silt, *clay*, and colloids) and which has good binding properties. This material is commonly referred to as *clay* binder.

Bitumen. A mixture of hydrocarbons, the predominant constituent of *asphalt*.

Bituminous cement. A heavy *binder* used in the preparation of bituminous mixtures. It is designated by selecting a penetration range or degree of hardness suitable for the type of construction.

Bituminous concrete. A mixture of *bituminous cement* and well graded, high quality *aggregate* thoroughly compacted into a uniform, dense mass.

Bituminous material. A material containing much organic matter, mostly in the form of tertiary hydrocarbons, which is usually described as *bitumen*.

Bleeding. (1) Formation of a film on asphalt pavement surface due to upward movement of the asphalt in the mix. (2) The flow of water from freshly placed *concrete* when no outside force is applied. Bleeding usually occurs with non-air-entrained *concrete*.

Bond. The adhesive force between steel *bars* or wires and hardened *concrete*. The steel is embedded in plastic *concrete*, and the bond develops as the *concrete* hardens.

Borrow. *Soil* removed from a designated location, called a borrow pit, for the purpose of providing fill on a given area.

Borrow (common). *Borrow* that is not suitable for use as *select borrow* but is suitable for less critical uses. Common borrow is referred to in the Specifications as Borrow Type F.

Borrow (select). *Borrow* graded and tested to conform to designated specifications. A high quality granular *soil* used for *backfilling* structures, constructing roadway bases, and for other significant applications.

Box culvert. A rectangular reinforced *concrete* drainage structure.

Brace. A diagonal member used to stiffen a framework.

Bridge. A structure, including supports, erected over a depression or an obstruction, such as water, highway, or railway and having a track or passageway for carrying traffic or other moving loads and having a length measured along the center of the roadway of more than 20' (6.096 m) between undercopings of abutments or extreme ends of openings for multiple boxes. Structures having an opening of 20 ft² (1.86 m²) or greater are included on the Department bridge inventory.

Bridging. The braces, or system of bracing, used between structural members to stiffen them and to distribute the load.

Bridge deck. The part of a *bridge* superstructure that provides direct support for vehicular and pedestrian traffic.

Bridge seat. The surface of an *abutment* or *pier* upon which the *superstructure* rests.

Built-up member. A structural member built from standard shapes that results in a single, stronger member.

Bulkhead. A temporary form, usually wooden, used to terminate a *concrete* pour. Bulkheads are placed at *construction joints*, *expansion joints*, or at the discretion of the Engineer.

Butt joint. (1) A joint with a vertical face that spans the width of the lane being paved. Butt joints are constructed when paving is stopped temporarily. (2) A union of two plates, end to end, without overlapping.

Buttressed retaining wall. A reinforced *concrete* wall having a vertical stem and a horizontal base with the brackets that connect the stem and base located on the opposite side from the one where soil is present.

Calcium chloride. A crystalline compound (CaCl₂) used for controlling dust on dirt roads, soil stabilization, ice removal, other road-conditioning purposes, as an *admixture* to accelerate the set of *concrete*, and for *curing* concrete.

Camber. A slight upward curve given to a plate *girder*, *beam*, *truss*, or *superstructure* during fabrication in order to compensate for the downward deflection that will result from the application of a load.

Cast-in-place pile. A *pile* constructed either by drilling a shaft in the earth and filling the shaft with *concrete*, or by driving a hollow sheet-metal shell by means of a pile hammer. After driving, the mandrel is withdrawn and the shell is filled with *concrete*.

Cement content. The cement content is the number of pounds (kilograms) of cement used in one cubic yard (cubic meter) of *concrete*. It is usually predetermined by the Specifications for the class of *concrete* desired. One bag of cement weighs 94 pounds.

Centering. The formwork for an arch and its supporting framework.

Chamfer. The edge or corner of a *concrete* structure, which is formed at an angle to give the structure a pleasing appearance and to prevent the edge or corner from chipping or breaking. Chamfer is accomplished by putting a *chamfer strip* into the corner of the formwork.

Chamfer Strip. A small V-shaped strip placed inside a corner of a form to produce a beveled edge on the *concrete*.

Channel. The bed where a stream of water flows. The term channel can also refer to a standard structural shape.

Cheekwall. A small section of *concrete* placed on the top of an *abutment* and adjacent to the wing walls. Its purpose is to conceal the bearing assembly and protect the bearings from the weather.

Chord. The principal member of a *truss*, on either the top or the bottom.

Clay. A fine-grained *soil* exhibiting high plasticity when remolded at its natural moisture content or following the addition of water and having a high strength when dried.

Clevis. A U-shaped fastening used to connect a rod to a pin.

Clip angle. A small angle used for fastening various members together.

Cofferdam. A structure built around a foundation site to keep water out of the excavation.

Cold joint. A longitudinal joint between different mats in a hot-mix asphalt pavement made by placing fresh asphalt against older, hardened or partially hardened asphalt.

Column. A vertical compression member that acts as a support. It may be constructed of *concrete*, steel, wood, or other materials. To be considered a column, the length of the member must exceed three times its least horizontal dimension.

Column ties. Lateral reinforcement used to hold longitudinal reinforcing *bars* in position in the *forms* while *concrete* is being placed, and also used to prevent the highly-stressed, slender longitudinal *bars* from buckling outward and bursting the thin *concrete* cover. Column ties typically form a rectangle or a circle around the longitudinal *bars*.

Composite-bridge construction. A unit consisting of three elements:

- (1) longitudinal steel or *prestressed concrete* beams,
- (2) a reinforced concrete *deck*, and
- (3) shear connectors that are used to tie the *deck* and the *beams* together.

Concrete. A mixture of *portland cement*, sand, and coarse *aggregate* to which water is added. The water, sand, and cement together form a “*paste*” that not only fills the *voids* in the coarse

aggregate, but also separates the coarse *aggregate* particles. The workability of a concrete mix depends on the amount and consistency of the *paste* in the mix.

Concrete masonry. As a general term, used to describe an artificial stone made basically from a controlled mixture of properly graded *aggregate*, *portland cement* and water. To obtain certain desired qualities, such as a certain texture or color, proportionately small quantities of other chemicals are added to the mixture.

Concrete Pour. The mass or volume of *concrete* placed in forms.

Conduit. A tube for receiving and protecting electric wires or cables.

Construction engineering. This consists of all staking and related surveying work performed on the project by the Contractor. The Department is responsible for establishing the lines and grades for extra work, the lines and grades for utility work, the original and final cross-sections of borrow pits, and the final cross sections for all excavation items, and for checking surveying and staking performed by the Contractor.

Construction joint. A plane surface between two sections of cast-in-place *concrete*, the second section having been placed on or against the first section after the first has hardened. Construction joints are typically formed when *concrete* placement must be stopped for a relatively long time.

Cope. To cut out the top or bottom *flanges* and web of a *beam* so that one member will frame into another. Figure I-2 below shows a cope cut on a beam.

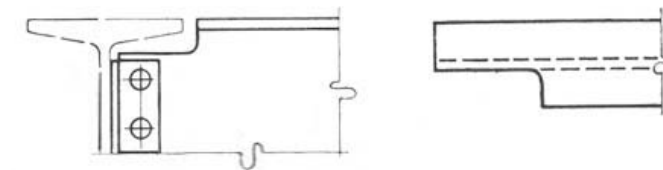


Figure I-2: Cope Cut on a Beam

Coping. A course of *concrete* or stone placed on top of a wall to shed water.

Copper flashing. Very thin sheets of copper, used to protect or seal the joints or edges of a structure.

Corbel. A projection from the face of a wall, supporting a load.

Cores. Cylinders of *concrete* cut from the pavement with a hollow drill. The drill grinds away a ring of *concrete* all the way through the pavement to leave the core undamaged in the center of the drill. Cores are usually 6" (150 mm) in diameter and are used to check the thickness, and sometimes the strength, of the *concrete*.

Counterport retaining wall. A reinforced *concrete* wall having a vertical stem and a horizontal base with brackets on the pressure face uniting the vertical section with the heel of the base.

Cover plate. A plate used in building up *flanges* of a steel *beam* or *girder* to give greater strength and area or to provide protection.

Crash wall. A massive *concrete* wall used for protection of bridge *piers* in case of a derailment near the structure.

Crib wall. A *retaining wall* composed of *precast concrete* headers and stretchers assembled to form a series of rectangular cellular structures along an *embankment*. The stretchers are the frontal, horizontal members of the cell. The headers are the lateral members of the cell.

Cribbing members. *Beams* used to form a framework for holding earth in place.

Curing. The protection of *concrete* against moisture losses and extremes of temperatures that enables the chemical reaction to progress to a point where satisfactory performance of the *concrete* in the structure is ensured.

Cut-back asphalt. *Asphalt cement* that has been rendered fluid by fluxing it with a light volatile petroleum distillate. Upon exposure to atmospheric conditions, the volatile distillate evaporates, leaving only the *asphalt cement*, which reverts to its original semi-solid condition. Cut back asphalts are classified as SC (slow curing), MC (medium curing), or RC (rapid curing).

Cutwater. The pointed end of a *pier* that is located in the flood plane of the stream. It is usually protected against chipping by granite facing, a steel angle, or a bent plate of wrought iron. Cutwaters are sometimes called icebreakers.

Cylinders (concrete). Concrete cylinders are made using cylinder molds and a sample from concrete being placed on a project. These cylinders are cured and tested in the lab, and are used to determine the compressive strength of the concrete. Refer to AASHTO T-22 for more information.

Dead load. The weight of the complete structure, including the roadway, sidewalks, parapets, pipes, conduits, cables, and other public utility services.

Deflection joint. An open joint in the *parapet* that allows for deflection of the *superstructure*.

Deformed bar. A steel reinforcing *bar* with projections on its surface that is used for reinforcement in *concrete*. The bond between the *concrete* and the steel is increased by deforming the *bars*.

Density (soil). The density of a *soil* is its volume-weight relationship, which is usually expressed in pounds per cubic foot (lb/yd³) [kilograms of soil per cubic meter (kg/m³)]. These volume-weight relationships are designated as wet density and dry density obtained by compaction. Of primary importance are:

- (a) the moisture content of the soil;
- (b) the nature of the soil, that is, its gradation and physical properties; and

(c) the type and amount of compactive effort required to achieve a specified density.

Department. An abbreviation used as a reference to the Delaware Department of Transportation.

Depressed key. An inverted *key* or groove in a construction joint.

Diagonals. Diagonal members used for stiffening the wind bracing.

Diaphragm. Transverse structural members made of *concrete* or steel that furnish lateral support to the *beams* in a structure.

Distributor. A tank truck capable of applying liquid *bituminous material* in a uniform manner with pressure, volume, and temperature under definite control.

Dowel. A metal *bar* extending across a *concrete* joint to transfer the applied load and prevent misalignment at the joint.

Drain. A pipe, trench, or ditch provided for the purpose of leading water away from the structure.

Drainage castings. Cast-iron items, such as manhole frames or inlets.

Dressed sheathing. A sheathing that has been smoothed by planing.

Drift pin. A cigar-shaped piece of steel used to line up rivet holes.

Drip notch. A recess formed on the underside of a *parapet* that prevents water from following the *concrete* into the supporting *beams* and causing deterioration of the members.

Driven to refusal. The condition of a *pile* that has been driven until it cannot go any further into the ground.

Drop hammer. A *pile* hammer, which is basically a heavy metal weight that is allowed to fall through the air and strike the top of a *pile*.

Dummy contraction joint. A joint made with an edging tool or cut with a diamond tipped saw to localize cracking along a line. The depth of the joint does not extend through the full depth of the *concrete*.

Edger. A small hand tool used to round the edges of *concrete* slabs before the *concrete* has hardened.

Elevation. (1) The vertical distance from the known datum to a given point or a level surface passing through that point. (2) The drawing showing a vertical section of a structure.

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Embankment. A structure of *soil*, soil aggregate, or broken rock placed between the embankment foundation and the subgrade.

Embankment foundation. The material below the original ground surface, the physical characteristics of which affect the support of the *embankment*.

Emulsified asphalt. A solution of *asphalt* and water that contains a small amount of an emulsifying agent. The emulsifying agent works with the water to liquefy the *asphalt* for construction operations.

End caps. Metal covers placed on the extreme ends of *parapet railings*.

Expansion bearing. The bearing device on the *expansion end* of the *beam*.

Expansion dam. A device used to control the expansion and contraction of a *bridge deck*, usually located over the *piers*.

Expansion end. The end of a *span* that is free to move in a longitudinal direction, usually designated on the Plans.

Expansion joint. A joint in *concrete* or steel that is filled with a compressible material and allows the structure to contract and expand without damaging the structure or introducing excessive stresses.

Expansion-joint material. Material that can be easily compressed and that is placed in an *expansion joint*.

Fabricated structural steel. Steel members made by fastening steel shapes, such as plates and angles, together by riveting or welding.

Falsework. A framework of wood or steel used to support the *forms* for a *concrete* structure. Also refers to construction needed to provide temporary support for a steel member during erection of a *bridge*. Falsework is sometimes referred to as shoring.

Fascia beam. A *beam* that exposes a face or side in its final position. Usually the outside *beam* of a structure.

FHWA. An abbreviation for the Federal Highway Administration.

Fillet weld. A triangular weld joining two surfaces at right angles to one another.

Fines. Small soil particles that will predominantly pass a US Standard 200 (75 μ m) sieve. Silt and *clay* particles are often referred to as fines.

Finishing concrete. The art of working the surface area of *concrete* to a desired texture.

Finishing machine. A mechanical device used to finish *concrete*.

Fixed bearing. A device that allows a *beam* to rotate but does not allow any longitudinal movement.

Fixed end. The end of a *beam* that is secured firmly and allows rotation only.

Flange. The projecting portion of a *beam*, channel, or *column*.

Float. A flat rectangular piece of wood, aluminum, or magnesium used for finishing *concrete*.

Flush expansion joint. A joint in which the *expansion joint* material meets the chamfered surface of the adjoining members.

Footing. The part of a structure that rests directly on the surface of the ground, pedestals, or *piles*. The primary purpose of a footing is to spread the load from the structure so as not to exceed the allowable bearing strength of the foundation bed.

Forms. Assemblies of wood or metal that hold *concrete* in place while it is hardening.

Form ties. Metal devices of various kinds that prevent the *forms* for a *concrete* member from being spread apart when the *concrete* is placed in the *forms*.

Foundation. The underlying material upon which a *footing* rests.

Foundation pressure. The resultant pressure on a foundation due to the loads applied to the structure.

Friction piles. *Piles* that normally derive their principal support from friction or shear between the sides of the *pile* and the surrounding *soil*.

Gage line. The *centerline* for rivet holes.

Girder. A horizontal member, either single or built-up, acting as a main member of a structure.

Girder dog. A mechanical device used to lift and place concrete *beams*.

Gore. The area immediately beyond the divergence of two roadways, bounded by the edges of those roadways.

Grade Line. A line on a drawing showing the elevation of the completed pavement along the length of a project. Also called the *profile*.

Grating. A heavy metal plate with slots or openings used to cover drainage inlets.

Gravel. Small stones and pebbles, or a mixture of small stones and sand.

Green concrete. *Concrete* that has set but has not hardened fully.

Green lumber. Wood that still contains most of the water that was in it when the tree was cut down.

Ground finish. A smooth finish on a *concrete* surface, obtained by removing a thin layer of *concrete* with an abrasive tool or a suitable grinding machine.

Grout. A relatively thin, liquid mixture of cement, fine sand, and water, or of cement and water only.

Guniting. A type of *portland cement mortar* “shot” into place by compressed air. The materials are mixed with water while being forced through a nozzle.

Gusset plate. A structural plate used to tie abutting members together at a joint.

Gutter line. The *profile* line at the intersection of the face of curb and the roadway slope.

Haunch. (1) An additional small section of *concrete* that is poured with the slab (monolithically) to give additional strength or support to the section itself and to the adjacent members. (2) The portion of the arch ring that is about midway between the skewback and the crown section. (3) The lower quarter of a circular pipe laid in a trench.

Headwall. A small *concrete* structure at the inlet end of a pipe.

Heel. The back portion of the *footing* from the intersection of the *batter* line to the back edge of the *footing*. The heel is usually under the fill.

High water elevation. The highest elevation known to which the water has risen at a specific point or structure.

Honeycomb. An area in *concrete* where there is a nest of particles of coarse *aggregate* and a lack of *mortar* to fill the spaces between them. Honeycombing typically results from incomplete consolidation.

Hook-bolt dowels. Short steel *bars* with hooked ends joined by a threaded connection, used to fasten one *concrete* section to another.

Horizontal clearance. (1) The clear distance from curb to curb of a roadway. (2) The distance from the *centerline* of the roadway to the nearest adjacent obstacle. (3) The clear horizontal distance between two obstacles.

Hot mix. See bituminous concrete.

Hydration. The process by which cement combines with water to form gel.

Hypotenuse. The longest side of a right triangle. The square of the hypotenuse is equal to the sum of the squares of the other two sides.

Initial set. The condition of *concrete* or *mortar* when it has hardened just enough to retain its shape without side support.

Inserts. Metal devices put in a *concrete* member during casting to provide a means for fastening other parts to the member later.

Intermediate. Structural members other than the main members, sometimes called secondary members.

Invert elevation. The lowest interior elevation in the arc of a pipe.

Joint filler. A flexible material used for filling or sealing joints while at the same time allowing movement of the joint. Joints are commonly sealed to keep the moisture out of the joint.

Keeper. A metal plate used to prevent the *beam* from separating from the bearing assembly. The keeper plate is bolted or welded to the *sole plate* or the *base plate*.

Key. A raised or depressed formation in a *concrete* joint surface for providing shear strength across the joint. Figure below shows a typical key.

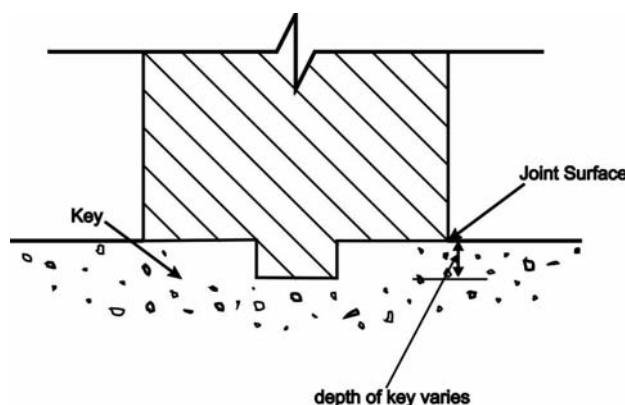


Figure I-3: Typical Key

Lacing. Small flat plates or straps used to connect two channels to form a *column*. Lacing is sometimes called lattice *bars*.

Laitance. A weak, soupy *mortar* that appears on the top surface of *concrete* during and immediately after consolidation. Laitance is most prevalent with non-air-entrained *concrete*.

Lateral. A drainage ditch, pipe, joint, or similar structure running perpendicular to the *centerline* of the road.

Leads. The parts of a *pile* driver that guide the *pile* and hammer while the *pile* is being driven. Refer to Section G602 for more information.

Level. An instrument used in surveying to determine elevations.

Lift. (1) A layer of *soil* placed as part of an *embankment*. (2) A spread and compacted layer of *bituminous concrete* or cement *concrete* in a form.

Longitudinal. A line, joint, ditch, or similar structure running parallel to the *centerline* of the road.

Lute. A hand tool used to smooth the surface of bituminous pavement during construction.

Mandrel. A temporary *pile* insert used to place thin steel shells for the construction of *cast-in-place concrete piles*.

Map cracking. A form of cracking in *concrete* where the cracks form a pattern that looks like the boundaries of a map. Map cracking is sometimes called alligator cracking.

Masonry plate. A steel *bearing plate* securely fastened to the *concrete* support of a *bridge*.

Mass concrete. Placed concrete for which heat generation during the hydration process requires taking special precautions. Generally, structures, in which all the *concrete* is within 5' (1.5 m) of the nearest boundary – that is, structures consisting entirely of sections less than 10' (3 m) thick – do not require the employment of special measures to control the heat of hydration.

Mastic. A mixture of *bituminous material* and fine mineral matter, usually intended to remain in a plastic state for an indefinite period of time that is used as an adhesive.

Mat. An assembly of lateral and longitudinal reinforcing *bars* tied together at their intersections.

Match line. A line drawn on a cross section parallel to the *centerline* of the section, indicating an additional part of the section is shown elsewhere in the drawing. The additional part of the section also has a match line and these two match lines will conform to each other.

Median. The portion of a divided highway separating traffic traveling in opposite directions.

Mesh. An assembly of steel wires welded together at their intersections.

Metal plate pipe. Small curved metal plates that are bolted together to form a large pipe.

Mid Span. The middle of the span or a point equidistant from both ends of the *span*.

Mineral filler. Any material that will pass a US Standard 200 (75 μ m) sieve. It is used in a *bituminous concrete* mix to fill the very small *voids* and thus increase the stability of the pavement. A broad range of materials are used for this purpose, including granular dust, which is finely powdered rock dust, 80 to 100 percent of which will pass a US Standard 200 (75 μ m) sieve loess, a fine porous material deposited by the wind, the particles of which are smaller than

sand grains and larger than *clay* particles; and fly ash, an artificial mineral filler produced as a by-product of burning pulverized coal, about 80 percent of which passes a US Standard 200 (75 μm) sieve.

Minimum vertical clearance. The least difference in elevation between the underside of the *superstructure* and the highest point of the roadway or streambed cross section. This clearance is defined in the Specifications.

Mixing time. The period of time during which all materials for *concrete* are in the revolving drum of the mixer.

Moisture-density relationship test. A laboratory method of testing *soil* to determine the soil densities at known moisture contents. Refer to AASHTO T-99 and T-180 for more information.

Mortar. A mixture of fine *aggregate* (sand) and *paste*. The *paste* not only fills the *voids* in the sand, but also separates the sand grains. Mortar will always contain air, either by design or otherwise.

Mud jacking. The act of raising a slab-on-ground, most commonly a paving slab, by pumping a mud slurry under pressure through holes drilled through the slab. Slurries may also be made from cement, *asphalt*, or similar materials .

Native asphalt. *Asphalt* produced by the natural processes of evaporation or distillation; *asphalt* as obtained directly from the earth.

Neoprene bearing pad. A rectangular synthetic rubber-like plastic used as a *bearing pad* for prestressed or steel *beams*.

Neoprene sponge. A closed-celled synthetic rubber-like plastic material used to seal the joint between the *abutment* and the edges of a prestressed *beam*.

Normal. Perpendicular.

Nosing. A protective steel facing on the upstream end of a *pier*.

Oakum. A loose fiber or hemp rope used for caulking joints between adjacent prestressed box *beams*.

Oblique triangle. A triangle composed of acute and obtuse angles. A triangle that does not contain a right angle.

Open joint. See Deflection Joint.

Organic soil. *Soil* with a high content of material such as plant fragments, peat, roots, and wood.

Revised: January 2004

Overburden. The top layer of material in a *borrow* pit that is removed prior to the removal of the underlying, acceptable *borrow*.

Parapet. An outside wall, usually of *concrete*, that extends above the finished surface of a *bridge* and runs parallel to the *centerline* of the *bridge*. It acts as a guardrail for the *bridge* structure. A parapet is also a wall extending above the roof surface of a building.

Parapet railing. A railing placed on the top of a bridge *parapet*.

Paste. a mixture of cement and water. The water-cement ratio determines the consistency of the paste, its strength, and its contribution to the workability of the concrete mix. Paste will always contain air, either by design or otherwise.

Pavement, flexible. A pavement structure that maintains intimate contact with and distributes loads to the subgrade and depends upon *aggregate* interlock, particle friction, and cohesion for stability.

Pavement, rigid. a pavement structure that distributes loads to the subgrade, having as one course a *portland cement concrete* slab of relatively high bending resistance. (AASHTO)

Pavement structure. The combination of subbase, *base course*, and surface course placed on a subgrade to support the traffic load and distribute it to the roadbed. (AASHTO)

- (a) *Base course.* The layer or layers of specified or selected material of designated thickness placed on a subbase or a subgrade to support a surface course.
- (b) *Subbase.* One or more layers of specified material thickness placed on a subgrade to support a *base course* (or in the case of rigid pavement, the portland cement concrete slab).
- (c) *Subgrade.* The top surface of a roadbed upon which the pavement structure is constructed.
- (d) *Subgrade Treatment.* Modification of roadbed material by stabilization.
- (d) *Surface Course.* Layer(s) of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer sometimes is called the “wearing course”.

Paving Notch. A recess left in the end of the *backwall* or *superstructure* to receive an approach slab.

Pedestal. (1) A small *concrete* support on the top of an *abutment* or *pier* that received the bearing assembly. (2) A *concrete* support below the *footing*, used when a poor *soil* condition exists less than 10' (3 m) below the bottom of the *footing* elevation.

Penetration. The vertical distance a *pile* moves as it is being driven into the ground.

pH. The actual concentration of hydrogen ions in a solution. The values for the pH of a solution range from 0 to 14, with distilled water being 7. A pH less than 7 indicates an acidic solution; a pH greater than 7 indicates an alkaline or basic solution.

Pier. A structure, usually of *concrete* or stone masonry, that is used to transmit loads from the bridge *superstructure* to the foundation, and is located between the *abutments*.

Pier cap. A cap placed on the top of *columns* to distribute the superimposed load.

Piles. Vertical or nearly vertical members, partly or entirely embedded in the ground, used to provide support for a structure where poor *soil* conditions exist.

Pintle. A steel pivot pin upon which the *rocker assembly* rotates.

Pipe bedding. The material located immediately below a pipe that acts as a foundation to support the pipe. Pipe bedding is divided into three classes: A, B, and C. These classes are defined in the Standard Construction Details.

Pipe Hanger. A metal bracket used to support a pipe suspended from a *bridge*. A pipe hanger is sometimes called a pipe support.

Pipe sleeves. Openings made in a *concrete* section by placing short sections of pipe in the *forms* before the *forms* are filled with *concrete*.

Pitch. Used in spiraled reinforced concrete *columns*, the pitch is the clear distance between spiral reinforcement for one complete revolution. Pitch also refers to the distance between the *centerlines* of rivet holes along the gage line.

Plain bars. Reinforcing *bars* that do not have a deformed surface; smooth reinforcing *bars*.

Plain concrete. *Concrete* with no steel reinforcement.

Plant mix. Material mixed at a central location and delivered to the Project site, usually *bituminous concrete*, *portland cement concrete*, or similar materials.

Plastic. The state or condition of *concrete* when it flows rather easily and can be readily placed in *forms*.

Plate. A flat, rectangular piece of steel.

Plumb. Vertical

Point. To fill the outside part of a joint or hole in masonry with dense *mortar*.

Portland cement. This is the type of cement most widely used in construction and the one that is usually meant when the term “cement” is used. It derives its name from its similarity to a stone

quarried on the Isle of Portland, England. It is a type of hydraulic cement, which means it can harden under water. When hardened, *portland cement* is resistant to moisture, as opposed, for example, to gypsum cement. Portland cement is produced in five types, described below, as well as several special types.

- (a) *Type I.* The usual type used for general construction, and the one that is usually provided unless otherwise specified.
- (b) *Type II.* A modification of Type I that gives off less heat during hydration, and consequently has a lessened tendency for shrinkage cracks in bulkier structures.
- (c) *Type III.* A formulation to provide earlier strength attainment, also called high early strength cement, it attains in seven days a strength equivalent to the strength of Type I cement after 28 days.
- (d) *Type IV.* A slow setting cement with a very low heat of hydration that is principally used for massive structures, such as dams, where the heat build-up during hydration could adversely affect the structure.
- (e) *Type V.* A high sulfate-resistant cement used for exposure to alkaline soils or sea water.

Post tensioning. Inducing stress into a *beam*, after the *concrete* is properly cured, using tensioning cables.

Precast concrete. Any *concrete* or masonry unit that is cast in molds or *forms* at a location other than its final location.

Precast piles. *Piles* made from *precast concrete*. Precast *piles* are useful because they can be cast and cured under controlled conditions to achieve maximum strength. Precast *piles* are heavy and bulky, making them difficult to move and drive without proper equipment.

Pre-molded expansion joint material. A compressible material shaped to form a joint of specified width.

Prestressed concrete. *Concrete* in which a compressive load is applied during the manufacturing process by means of steel strands, wires, or rods, which are in tension in the *concrete*. The load is transferred as a compressive load in the *concrete* by means of a bond with the steel or by using special fixtures where the tendons emerge from the *concrete*.

Pressure. A force per unit area, measured in psi, ksi or pascals.

Prime coat. The first application of material, such as waterproofing or paint protection, to a surface.

Profile. The elevations of a series of points along a continuous line. Profiles are required for the construction of roads, drives, pipelines, drains, ditches, etc. They are usually plotted on the drawing with the horizontal scale greater than the vertical scale in the ratio of 10:1.

Pumping. In a pavement, the loss of fines from the subgrade through cracks or joints in the pavement under the action of traffic. Fines are carried through the crack by water forced through

the crack when a vehicle depresses the slab slightly on a fine-grained, nondraining base or foundation.

Radius. The distance from the center of a circle to any point on the circumference of that circle.

Raked construction joint. A construction joint that is purposely made uneven and coarse to provide a greater bond between the *concrete* sections, such as between a *parapet* wall and the top of a deck.

Reinforced concrete. *Concrete* in which steel reinforcement is embedded.

Reinforcing steel. Steel *bars*, wires, or rods placed in *concrete* to bear tensile forces. Epoxy coating is often used on reinforcing steel to resist corrosion. Non-coated reinforcing steel is sometimes referred to as black steel.

Retaining wall. A wall built to hold back earth or loose rock so that the material behind the wall will not slide or cave in.

Retarder. An *admixture* that slows or retards the setting of *concrete*, but has little or no effect on strength gain after the initial set.

Right triangle. A triangle with one ninety degree angle.

Riprap. A material, usually consisting of stones, broken *concrete*, or similar materials used to stabilize an *embankment* or a spillway in order to control erosion.

Rocker assembly. A device located at the bridge supports to allow movement of the *bridge* that is caused by deflection and expansion. Rocker assemblies may be located at intermediate points along a *beam* or at the free end. Figure I-4 shows a typical rocker assembly.

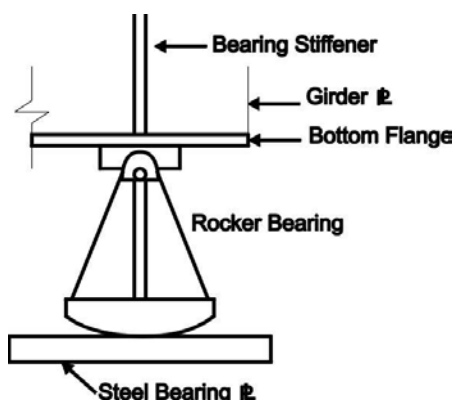


Figure I-4: Typical Rocker Assembly

Rocker bearing. Movable support at one end of a bridge *span* that rocks on its base to provide for changes in *span* length due to temperature variation.

Revised: January 2004

Rollers. Steel cylinders used to provide support so that the structure can move in the direction of the *span*.

Rubber compounds. *Bituminous materials* mixed with a small amount of rubber and used for filling and sealing joints and cracks.

Salamander. A device used to provide heat in the cold weather.

Scaling. The peeling off of a thin layer of *concrete* from the finished surface of a pavement.

Score. To make a long, small depression in the face of *abutments*, *parapets*, *retaining walls*, or wingwalls to add beauty to the structure.

Screed. A long piece of wood or metal moved across the surface of newly-placed *concrete* with a sawing motion to consolidate the *concrete* and smooth the surface.

Scuppers. Special cast-iron drain inlets used to dispose of surface water on *bridge decks*.

Sealer. A *bituminous material* used for filling and sealing joints and cracks.

Segregation. The separation of fine material from coarser material. In bituminous concrete, segregation refers to the tendency of larger particles to roll to the outside during handling, producing a lack of uniformity in the material. In *concrete*, segregation refers to the separation of the coarse *aggregate* from the *mortar* or from the main mass of the *concrete*.

Set. The hardening of a mixture of *grout*, *mortar*, or *concrete*.

Setting up. The process by which the cement in freshly mixed *concrete* or *mortar* combines with water and hardens.

Settlement. The downward movement of a structure due to its own weight, the loads that it supports, or shrinkage of the supporting *soil*.

Shear blocks. Small *concrete* blocks used to prevent lateral movement of the *superstructure*.

Shear connectors. Devices for keeping one member of a structure from sliding on another. Studs, channels, and reinforcing steel are examples of shear connectors on bridge *beams* used to fasten the *beams* to the *bridge deck* to develop composite action.

Shear key. A small recess or depression between different pours of concrete or between a structure such as a dam and the underlying ground. Shear keys are used to resist shear forces across a joint.

Shim. A thin flat metal plate used to raise the bearing assembly on a *bridge seat* where the *bridge seat* is too low and to adjust the expansion dam on a *bridge*.

Skew. At an angle other than a right angle; neither parallel nor perpendicular.

Skin friction. Friction between the outside surface, or skin, of a *pile* and the surrounding *soil*. Skin friction resists vertical movement of the *pile* in the *soil*.

Sliding plate. A plate designed to bridge an *expansion joint* and prevent the accumulation of roadways debris on the *bridge seats*. Apron plates usually are rigidly connected to the end floor *beam*.

Slope Paving. *Concrete* slabs used in locations susceptible to erosion that serve as protection against the undermining of the *footing* of a structure.

Slope wall. A pavement constructed on the side slope of an excavation or *embankment* to prevent water from washing away the *soil* on the slope.

Slump. A measure of the fluidity, softness, or wetness of fresh *concrete*. It is determined by measuring the number of inches (millimeters) a specific sample slumps or subsides when a conical form is removed from the fresh *concrete* sample. The greater the number of inches (millimeters) of subsidence, the higher the slump, and the wetter or softer the *concrete*.

Soffit. The underside of a cornice, overhang, stairwall, or similar structure.

Soil. Soil has been given many definitions by those concerned with aspects of its use. However, the highway engineer can consider soil as “sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks, and which may or may not contain organic matter”. (AASHTO)

Sole plate. A plate located at the base of a *beam*, partition, *column*, or similar structure to distribute the load at the point of support.

Spalling. The crumbling of *concrete* at a joint or along the surface. Also, a fragment of *concrete* broken off in this manner.

Span. The distance measured between supports.

Spandrel. The wall over the haunches of the arch and below the level of the top of the crown. This does not include the arch-ring. The spandrel is sometimes called the spandrel-wall.

Specific gravity. The ratio of the weight of the absolute volume (solid volume) of a material to the weight of an equal volume of water.

Specifications. The compilation of provisions and requirements for the performance of the prescribed work. This includes the Standard Specifications, Supplemental Specifications, and Special Provisions. The Specifications pertain to, among other things, the method and manner of performing the work, the quantities of material to be furnished under the Contract, and the quality of the finished work. Refer to Part B for additional information.

Splice. A connection of two parts of a structural member used to increase its length.

Spot-weld. A small intermittent weld that temporarily joins two structural members during erection or fabrication.

Stabilization. Modification of *soils* or *aggregates* by incorporating materials that will increase load bearing capacity, firmness, and resistance to weathering or displacement. (AASHTO)

Stagger. To alternate.

Steel beam piles. *Piles* made of structural steel, usually formed into H sections.

Steel pipe piles. Sections of steel pipe driven into the ground and usually filled with *concrete*.

Stem. The vertical section of a cantilever *abutment*.

Stiffener. A vertical steel plate or angle used to give additional strength to a steel *girder*.

Stirrup. A steel *bar* in a reinforced concrete *beam*. The *bar* is usually bent in the form of a “U” and helps resist diagonal tension stresses.

Stringer. A *bridge* floor member that is parallel to the bridge *centerline*.

Strip. To remove *forms* from *concrete* that has hardened.

Stub abutment. A short vertical abutment usually found at the top of an *embankment*.

Stud. Vertical wooden members used for reinforcing sheeting and plywood *forms* against distortion due to the weight of the *concrete*.

Subbase. See Pavement Structure.

Subgrade. See Pavement Structure.

Substructure. The portion of a *bridge* below the top of *abutments* or *piers*. It consists of a *footing* and an *abutment* or *pier*, and may also consist of piles upon which the footings are constructed. The function of the substructure is to support the *superstructure* and transmit the loads down into the ground.

Surface or free moisture. All the water retained by *aggregates* in excess of the quantity required for practical internal saturation. It is expressed as a ratio of the weight of this water to the weight of the surface-dry internally saturated *aggregates*.

Superelevation. The banking of the outside of a roadway on a horizontal curve or runoff.

Superstructure. The parts of a *bridge* above the level of the end supports, including the *beams*, the *bridge deck*, and the *parapet* wall.

Symmetrical. An identical formation of elements on opposite sides of a neutral axis or *centerline*; a mirror image.

Tachometer. A gauge used on an asphalt *distributor* to accurately measure the speed of the vehicle.

Tack weld. See Spot Weld.

Tamper. A tool for compacting *backfill* in areas that cannot be reached by rollers.

Tell-tales. Tell-tales are wooden strips or weighted wires freely suspended from concrete *forms* to match marked stakes below, used to determine subsidence of forms while loading.

Tendon. A wire, strand, or rod used to apply a prestressing force to *prestressed concrete*.

Test boring. A subsurface exploration showing the cross section of the *soil*, location of the holes where the *soil* was sampled, and other information pertaining to the *soil*.

Ties. Steel wire used for securing steel reinforcement at intersections or overlapping joints.

Toe. The front portion of the *footing*, from the intersection of the vertical face of the *abutment* to the front edge of the *footing*.

Toe wall. A *concrete* wall that prevents scouring under the apron of a drainage structure. Toe walls are sometimes called cut-off walls.

Tooled edge. The edge of a *concrete* structure that has been rounded with an edger.

Torque wrench. A calibrated wrench with a gauge that indicates the torque on a nut or bolthead, usually in joules.

Transit. An instrument used in surveying for horizontal control, i.e., measurement of angles, lines, and other geometric features.

Transverse. A theoretical line running perpendicular to the longitudinal or centerline of a roadway.

Tremie. A pipe, open at the top and bottom, used to drop fresh *concrete* vertically without *segregation*. Tremies are usually used for placing *concrete* in water.

Trial mix. A *concrete* mixture designed by the Contractor using the materials it intends to furnish for use on the Project.

Revised: January 2004

Truss. An assemblage of structural members to form a rigid framework.

Turn-of-the-nut method. A method of tightening high-strength bolts to the required minimum tension when assembling steel on the Project.

Vertical clearance. The clear vertical distance between the surface of the pavement and an overhead structure.

Vibration. The act of rendering fresh *concrete* into a quasi-liquid state, by the application of high-frequency, vibratory impulses, for the purpose of consolidation in the *forms*.

Vibrator. A mechanical device for shaking fresh *concrete* rapidly so that entrapped air and excess water is released and the *concrete* settles firmly in place in the *forms*.

Vitrified clay liner plates. Plates that are attached to the face of *concrete* to protect it from the harmful effects of acidic water.

V-notch. A notch formed at a construction joint by two pieces of chamfer.

Void. A small air pocket or hole in a material, usually caused by a lack of consolidation.

Volume change. Expansion and contraction of a material resulting from wetting and drying or temperature variations.

Voussoir. Any of the wedge-shaped stone pieces of which an arch is composed, such as the keystone.

Walers. Horizontal members used to help hold *forms* in position. Walers are also used to brace cofferdams. Walers are sometimes called wales.

Water-cement ratio. (1) The ratio of the weight of total water to the weight of cement in a batch of *concrete*. (2) The number of gallons (liters) of water per sack of cement in a batch of *concrete*.

Waterproofing. The application of an *asphalt*, epoxy, or silicon material to the unexposed side of a *concrete* structure to protect it from water damage.

Water table. The depth below the ground surface at which the soil is nearly saturated with water. If an excavation goes below the water table, water can be observed to flow into the excavation. The water table is also referred to as the groundwater table.

Web. A plate or thin portion between stiffening ribs or *flanges*.

Weep holes. Small drainage holes placed in a structure to permit trapped water to escape.

Wingwall. A part of a bridge *abutment* outside the main body of the structure. Its purpose is to retain the approach fill.

- (a) *U-wing*: A type of wingwall where the wings are parallel or nearly parallel to the centerline of the roadway.
- (b) *Flared Wing*: A type of wingwall where the wings are at a skewed angle to the centerline of roadway.

Workability of portland cement concrete. The ease with which the *concrete* mixture may be mixed, handled, transported, and placed into its final position with a minimum loss of homogeneity.

Working drawings. Stress sheets, shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, bending diagrams for reinforcing steel, or any other supplementary plans or similar data which the contractor is required to submit for approval.

Working point. A specific point shown on the *bridge* plans from which angles and distances are measured to construct the *bridge* structure.

Yield. (1) The quantity of *concrete*, expressed in cubic yards (cubic meters), that is produced by a given batch. (2) Number of square yards (square meters) of surface covered by a *distributor* load of *asphalt*.

[illegible]

NOTES

This image shows a full page of blank handwriting practice paper. It features multiple sets of horizontal lines, each set consisting of three lines: a solid top line, a dashed middle line, and a solid bottom line. These sets are repeated down the entire page to provide a guide for letter height and placement. The paper is otherwise completely blank, with no margins, text, or other markings.

This image shows a single sheet of white paper with horizontal blue ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

This image shows a full page of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page, providing a template for handwriting practice or general writing. There are no margins, text, or other markings on the page.